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(54) IMPROVEMENTS IN OR RELATING TO THE TREATMENT OF CHICORY

(71) We, GLENTON AND MITCHELL LIMITED, of 41 Frost Avenue, Auckland Park, Johannesburg, Transvaal, Republic of South Africa, a company registered according to the laws of the Republic of South Africa, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

THIS invention relates to the treatment of chicory.

Raw dried chicory (cichorium intybus) of good quality consists of approximately 80% by weight of inulin. Inulin $(C_6H_{10}O_5)_x$ is a natural polysaccharide which can be hydrolised by water into fructose. The fructose molecule has a hydroxyl group (OH) and a hydrogen atom (H) attached to it and when, in a chain, the hydoxyl group of one molecule combines with the hydrogen atom of the adjacent molecule to form water (H_2O) which is then removed, the residual compound is inulin.

Chicory is roasted in order to excite the inulin molecule by heat energy so as to invert it into fructose which is subsequently caramelised. However, fructose can only be formed with the addition of 29 molecules of water for each molecule of inulin.

In the conventional roasting process, raw dried chicory containing about 6% by weight of residual water is fed into a steel drum which is mechanicaly rotated throughout the process. The drum is heated to approximately 160°C by means of an oil or gas fired furnace and the residual water is naturally driven off. In this process the formation of fructose under the influence of heat inevitably results in the degradation of the fructose itself, and of the lignins, and the cellulose and, in fact, of any compound in the raw root having a chemical composition capable of supplying the water which is required for inversion of the inulin into fructose.

In the conventional process, the chicory darkens and when the operator judges the product to have reached the correct stage, it is discharged from the drum, cooled and ground.

Quite apart from the considerations mentioned above, the known process produces a considerable amount of dust, fume and objectionable smoke. This emission can very largely be controlled by careful roasting coupled with the use of scrubbers, afterburners and other gas purifiers. However, purification of exhaust fumes can be expensive, resulting in increased cost of production and therefore in increased cost of the final product.

Roasting loss calculated on the raw dried root as fed into the drum normally varies between 17% and 25%. It is caused:

(a) By the grinding action of the rotating drum
(b) By the degradation of the chicory due to unavoidable chemical changes in its constituents when chicory is roasted in the normal manner
(c) By degradation due to poor heat control of the roasting root. Control of furnace heat can be rendered difficult for a variety of reasons such as variations in the quality of the root, the influence of the weather on the flow through the chimney stack, and the design and construction of the roasting machine itself.

The object of the present invention is to obviate or at least minimise the disadvantages mentioned above.

According to the present invention a process for treating chicory comprises the steps of contacting raw dried chicory root containing inulin with dry steam in a closed

reaction vessel for a predetermined period of time, to invert the inulin to fructose, and subsequently removing the treated chicory containing fructose from the vessel and allowing it to cool.

Preferably the raw dried chicory root is contacted by said dry steam in the closed reaction vessel without agitation for said predetermined period of time. The steam may be introduced into the vessel at a pressure between 1 and 6 bars, but a pressure of approximately 4 bars is preferred. The steam may be supplied by a conventional boiler and after being dried in manner known per se, it is led into the reaction vessel containing the raw dried root. At a pressure of 4 bars, the steam will raise the temperature of the chicory to approximately 143°C. If a lesser or greater pressure is used within the range stated above, the corresponding temperature will vary between 110°C and 180°C.

At the pressure and temperature prevailing inside the vessel, the inversion of inulin to fructose takes place with a minimum of degradation due to the presence of water molecules at the same degree of excitation as the inulin molecules.

The residence time of the chicory in the reaction vessel before the steam supply is shut off may vary between 10 and 30 minutes, a residence time of about 25 minutes with a steam pressure of 4 bars being about average. The actual residence time will depend not only on the pressure and temperature being used but also on the organoleptic qualities of the final product desired by the consumer.

After the steam has been shut off, the vessel may be evacuated to allow the chicory to cool and dry. It is preferred, however, to pump hot air through the vessel at a temperature ranging from about 102°C to 160°C for approximately 30 minutes while the chicory is still in situ. The preferred air temperature is approximately 130°C.

Since there is absolute temperature control throughout the reaction vessel, very little if any heat degradation of the chicory takes place. As the chicory is stationary in the vessel and is not subjected to agitation, no physical damage is caused and no dust is produced. Cyclones and dust separators with their attendant fire risk are therefore unnecessary.

Finally, since there is minimal degradation of the chicory, no objectionable smell or smoke is produced at any stage of the process and pollution of the atmosphere is avoided without the necessity of taking complex and expensive steps to this end.

The process of the invention will now be further described, by way of example, with reference to the accompanying drawing which illustrates, in diagrammatic form, apparatus suitable for carrying it out.

Referring to the drawing, numeral 1 denotes the reaction vessel which is surrounded by a steam jacket 2. An outlet 3 is situated at the bottom of the vessel 1 and it is controlled by a valve 4. A duct 5 controlled by a valve 6 leads into the outlet 3 and at its oposite end to the intake of a centrifugal fan 7 which discharges to atmosphere.

Steam is admitted to the upper part of the vessel 1 through a duct 8 controlled by a valve 9.

A separator 10 provided with a steam trap 11 is incorporated in the duct 8.

Numeral 12 denotes a heat exchanger communicating with the duct 8 and provided with control valves 13 and 14. Atmospheric air may be pumped into the heat exchanger by means of a centrifugal fan 15.

The raw dried chicory root is placed in the vessel 1 which is then closed to atmosphere. Dry steam is admitted to the vessel by opening the valve 9. After the predetermined treatment time has elapsed, valve 9 is closed and hot air is pumped into the vessel by the fan 15 on opening the valve 14.

Finally, the vesel is vented to atmosphere by closing the valve 14 and opening the valve 6. The treated chicory is then removed from the vessel through the cover 16.

WHAT WE CLAIM IS:—

1. A process for treating chicory comprising the steps of contacting raw dried chicory root containing inulin with dry steam in a closed reaction vessel for a predetermined period of time, to invert the inulin to fructose and subsequently removing the treated chicory containing fructose from the vessel and allowing it to cool.

2. A process according to claim 1, in which the steam is introduced into the vessel at a pressure between 1 and 6 bars.

3. A process according to claim 1, in which the steam is introduced into the vessel at a pressure of approximately 4 bars.

4. A process according to claims 1, 2 or 3, in which the residence time of the chicory in the reaction vessel is between 10 and 30 minutes.

5. A process according to any of the preceding claims, including the step of pumping hot air through the reaction vessel after the steam has been shut off.

6. A process according to claim 5, in which the temperature of the hot air is between 102°C and 160°C.

7. A process according to claim 5, in which the temperature of the hot air is approximately 130°C.

8. A process for treating chicory sub-

stantially as hereinbefore described with reference to the accompanying drawing.

9. Chicory whenever treated in accordance with the process of any of claims 1 to 8.

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